

AP Statistics  
Linear Transformations Exploration

Key

The following data is from quizzes in an Algebra 2 class. The quiz was out of 40 points.

20	20	25	25	30	30	30	30	35	40
40	40	28	29	28	32	36	36	38	34
36	26	24	26	34	36	32	18	12	36

- Enter the data into the calculator in L1. Determine the shape of the distribution (create a graphical display of the data) and find the summary statistics for the data. Put this information into the table below under "Original data"
- I decide that the quiz should be weighted as 50 points, so I will add 10 points to each score. Find the shape and the summary statistics for the new distribution. To do this....
  - In the calculator, go to the top of L2.
  - Enter " $L1+10$ " and hit Enter. This should add 10 points to each score in L1.
  - Put summary statistics into the table below under "Add 10".
- Instead I think I might weight it as 80 points, so I double each original score. Find the shape and summary statistics for the new distribution.
  - In the calculator go to the top of L3.
  - Enter " $L1 \times 2$ " and hit Enter. This should double each score in L1.
  - Put summary statistics into the table below under " $\times 2$ ".
- Another option I might consider is to count the quiz as 100 points, so I double each original score and add 20 points. Find the shape and summary statistics for the new distribution.
  - In the calculator go to the top of L4.
  - Enter " $L1 \times 2 + 20$ " and hit Enter. This should double and add 20 points to each score in L1.
  - Put summary statistics into the table below under " $\times 2 + 20$ ".

	SHAPE	Mean	St. Dev.	Min	Q1	Med	Q3	Max	IQR	Range
Original data	left skew	30.2	6.955	12	26	30	36	40	10	28
Add 10	same	40.2	6.955	22	36	40	46	50	10	28
$\times 2$	same	60.4	13.910	24	52	60	72	80	20	56
$\times 2 + 20$	same	80.4	13.910	44	72	80	92	100	20	56

Answer the following:

1. How has the general shape of the distribution changed in the 4 situations?

It hasn't - same!

2. Compare the means and medians for the 4 situations.

a. When we added 10 how did the mean and median change?  $+10$

b. When we multiplied by 2 how did the mean and median change?

$\times 2$

c. When we multiplied by 2 and added 20 how did the mean and median change?

$\times 2 + 20$

d. If I added 5 points to each score and then found the percentage out of 40 points, ~~out of 40~~, how could you have find the new mean and median? What would they be?

$+ 5 \div 40$

mean = 0.88

Med = 0.875

3. Compare the standard deviation, IQR, and range for the 4 situations.

a. When we added 10 how did the standard deviation, IQR and range change?

$+ 0$

b. When we multiplied by 2 how did the standard deviation, IQR, and range change?

$\times 2$

c. When we multiplied by 2 and added 20 how did the standard deviation, IQR, and range change?

$+ 0 \times 2$

d. If I added 5 points to each score and then found the percentage out of 40 points, ~~out of 40~~, how could you find the new standard deviation, IQR, and range? What would they be?

$+ 5 \div 40$

\* only do  $\div 40$

~~0~~

$s = 0.174$

IQR = 0.25

range = 0.70

4. In General if we multiply every value in a data set by a constant ( $a$ ) what happens to each summary statistic?

- a. Mean  $\times a$
- b. Median  $\times a$
- c. Quartiles  $\times a$
- d. Standard Deviation  $\times a$
- e. IQR  $\times a$

5. In General if we add a constant( $b$ ) to every value in a data set what happens to each summary statistic?

- a. Mean  $+b$
  - b. Median  $+b$
  - c. Quartiles  $+b$
  - d. Standard Deviation  $+0$
  - e. IQR  $+0$
- 

So..... Fill in these notes:

Adding a constant ( $b$ ) changes the mean, median, quartiles

- These are all measures of center

Multiplying by a constant ( $a$ ) changes the mean, median, quartiles, std. dev., IQR

- These are measures of center and spread

**EXAMPLE:** I have a distribution with the following statistics. If I multiply each observation by 4 and add 6, what will the new statistics be?

ORIGINAL:

Mean = 25.3

Median = 21

Std. dev = 3.1

IQR = 8

$\times 4 + 6$

NEW:

mean = 107.2

Median = 90

std. dev = 12.4

IQR = 32